

A Natural Hybrid between *Carex curvicolis* and *C. forficula* (Cyperaceae), and the Lectotypification of *C. ×musashiensis*

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Carex ×musashiensis Ohwi is newly reported from Miyoshi-shi, Tokushima Pref., Shikoku. This plant was described from Mt. Takao, Tokyo, as a hybrid between *C. curvicolis* Franch. & Sav. and *C. thunbergii* Steud. However, this plant is reinterpreted as a hybrid between *C. curvicolis* and *C. forficula* Franch. & Sav. by the ecological and morphological evidence at the new locality. The lectotype of *C. ×musashiensis* is designated here.

Key words: *Carex curvicolis*, *Carex forficula*, *Carex ×musashiensis*, *Carex thunbergii*, hybrid, lectotype.

One of the authors, Kinoshita, found a sedge which is presumed to be a natural hybrid between *Carex curvicolis* Franch. & Sav. and *C. forficula* Franch. & Sav., at Miyoshi-shi, Tokushima Pref., Shikoku, Japan in 2008. The sedge was growing on rocks or rocky river bed along a mountain stream (Kuro-kawa) together with these two species and showed intermediate forms between them.

Natural hybrids have been known for both *Carex curvicolis* and *C. forficula* as one of the parent species (Ohwi 1936, Koyama 1956, Fujiwara and Matsuda 1991), but the hybrid between these two species has not been reported. However, on the basis of morphological investigation, we identified this hybrid to *C. ×musashiensis* Ohwi described from Mt. Takao, Tokyo, although it was originally presumed as a natural hybrid between *C. curvicolis* and *C. thunbergii* Steud. Thus far, this hybrid has been known only from the type locality.

Materials and Methods

We made field surveys at Miyoshi-shi in 2008, 2009 and 2010. Some individuals of *Carex curvicolis*, *C. forficula* and *C. ×musashiensis* were transplanted and grown at Naruto-shi, Tokushima Prefecture, for comparative studies.

Morphological observations are based on living and dried materials obtained from Miyoshi-shi, and herbarium materials housed at KYO and SAPS.

Pollen grains were stained with aceto-carmin solution to estimate the pollen fertility.

Results and Discussion

Morphological comparison between C. curvicolis, C. ×musashiensis, and C. forficula

Comparison of morphological characters between *C. curvicolis*, *C. ×musashiensis* and *C. forficula* is shown in Table 1.

Because these plants grown on rocks on mountain streamlets (Fig. 1A), it is often

Table 1. Comparison of morphological charcters between *Carex curvicollis*, *C. ×musashiensis* and *C. forficula*

	<i>C. curvicollis</i>	<i>C. ×musashiensis</i>	<i>C. forficula</i>
Rhizome	short creeping	short elongated	condensed
Reticulate fiber of basal sheath	not formed	inconspicuous, often unraveled	conspicuous
Staminate spike			
Length	1.1–1.2 cm	1.9–3.6 cm	2.6–3.6 cm
Width	1.2–2.3 mm	2.5–3.5 mm	2.0–2.5 mm
Stalk length	10.8–19.5 mm	11.0–19.5 mm	0–13.0 mm
Scale size	2.3 × 1.0 mm	3.5 × 1.2 mm	3.0 × 0.5 mm
Pollen grain	normal	sterile	normal
Pistillate spike			
Direction at anthesis	rather spreading	slightly spreading	erect
Scale size	2.2 × 1.0 mm	2.0 × 1.0 mm	3.3 × 1.0 mm
Perigynium	"lanceolate, often curved 3.5 × 1.0 mm"	ovate gradually narrowed to a long beak, 3.5–4.1 × 1.2–1.5 mm	ovate, abruptly rather long beaked, 3.5–4 × 1.5 mm
Beak apex	entire	slightly 2-toothed	2-toothed
Stigma	3-fid	2- and 3-fid intermingled	2-fid
Achene	maturing	not maturing	maturing

difficult to obtain good specimens showing the underground characters. Plants of all these taxa are densely tufted (Fig. 1B), but the morphology of rhizome is different among each *Carex curvicollis* has short creeping rhizomes (Fig. 1C, arrowheads), while the rhizomes of *C. forficula* are condensed without bearing creeping rhizomes. *Carex ×musashiensis* has an intermediate character, short elongated rhizomes (Fig. 2).

Carex forficula is characterized by basal sheathes forming conspicuous reticulate fibers (e.g., Katsuyama 2005: 95, photo), but this character is not observed in *C. curvicollis*. In *C. ×musashiensis*, the basal sheath is splitting ventrally into reticulate fibers like *C. forficula*, but the reticulum is inconspicuous and often unraveled.

The pistillate spikes are clustered near the tip of culms in *C. curvicollis*, and in the other two taxa they are rather evenly distributed in distal part of culms.

The perigynia of *C. curvicollis* are lanceolate

and the neck is often curved as in its epithet “*curvicollis*” (curvedly-necked). The apex of the perigynia is membranous and entire. Those of *C. forficula* are ovate and abruptly long-beaked. The apex is distinctly 2-toothed as in its epithet “*forficula*” (small scissors). The perigynia of *C. ×musashiensis* are intermediate between them, being ovate and gradually narrowed to a long beak with the apex slightly 2-toothed (Fig. 1D). The achenes of *C. curvicollis* and *C. forficula* are developing well after anthesis, but those of *C. ×musashiensis* are not maturing and perigynia are dorsiventrally compressed.

The number of stigmatic branches is an important taxonomic character in *Carex*. Those of *C. curvicollis* and *C. forficula* are 2 and 3 respectively. In *C. ×musashiensis*, the stigmas are 2-fid or 3-fid showing intermediate status and these are intermingled in a spike (Fig. 4E).

After anthesis, the staminate spikes of *C. curvicollis* and especially of *C. forficula* are bearded with exserted persistent filaments. In *C. ×musashiensis*, such exserted filaments are

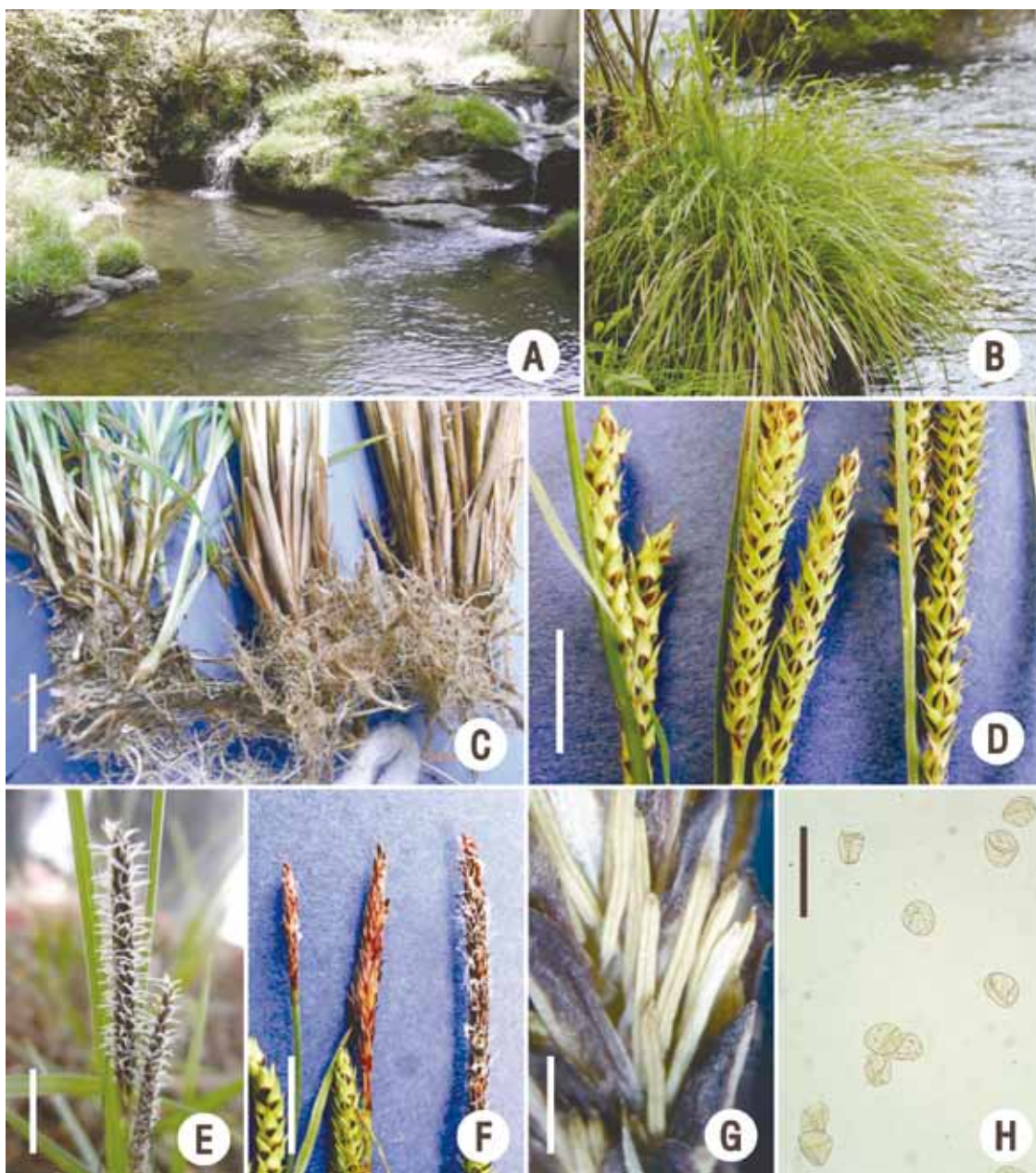


Fig. 1. A. Habitat of *Carex x musashiensis* at Miyoshi, Tokushima Pref. The hybrids are growing on rocks or rocky riverbed with *C. curvicollis* and *C. forficula*. B. Habit of *Carex x musashiensis*. C. Basal parts of *C. curvicollis* (left), *C. x musashiensis* (center), and *C. forficula* (right). *C. curvicollis* has short creeping rhizomes (arrowheads), and *C. forficula* conspicuous reticulate fiber on basal sheath. D. Pistillate spikes of *C. curvicollis* (left), *C. x musashiensis* (center), and *C. forficula* (right). Note the difference of the shape of perigynia. E. Pistillate spikes of *C. x musashiensis* in anthesis showing 2- and 3-fid styles intermingled in a spike. F. Staminate spikes of *C. curvicollis* (left), *C. x musashiensis* (center), and *C. forficula* (right) after anthesis. In *C. curvicollis* and *C. forficula*, the spikes are bearded with exerted filaments. In *C. x musashiensis*, however, the filaments are hardly observed because the anthers remain in the scales without dehiscing. G. Part of a staminate spike of *C. x musashiensis* showing indehiscent anthers remained in the scales after anthesis. Scales spread out to show anthers inside. H. Shrunken pollen grains of *C. x musashiensis*. Bars = 2 cm (C), 1 cm (D, E, F), 1 mm (G), and 100 μ m (H).

hardly observed (Fig. 1F), because the anthers mostly remain in the scales without dehiscing, resulting in swollen staminate spikes after anthesis (Fig. 1G). The pollen grains of *C. ×musashiensis* are shrunk without being stained by aceto-carmin solution (Fig. 1H), although in the other two species almost all pollen grains were stained well suggesting their high fertility.

Carex ×musashiensis lacks normally developed pollen grains, and the achenes never mature. Many morphological characters of *C. ×musashiensis* are intermediate between those of *C. curvicolis* and *C. forficula*. And these two species are sympatrically growing with *C. ×musashiensis* as shown above. These support that *C. ×musashiensis* is a natural hybrid between *C. curvicolis* and *C. forficula*.

Relationship with Carex thunbergii

Ohwi (1936) presumed that *C. ×musashiensis* is a hybrid between *C. curvicolis* and *C. thunbergii*. However, it is unlikely that *C. thunbergii* is one of the parent species of *C. ×musashiensis* because of the differences in the ecological and morphological characters.

Carex curvicolis and *C. forficula* prefer the habitat along rocky streamlets in mountains, but *C. thunbergii* is rather common in rice paddies and in swampy river flats. At the localities where the hybrid was found, *C. thunbergii* was not growing sympatrically.

The reticulate fibers of basal sheath (although inconspicuous and often unraveled) and the slightly 2-toothed apex of perigynia are characteristics to *Carex ×musashiensis*. Because they are not shared with *C. curvicolis*, it is expected the other parent has the characters. *Carex thunbergii*, however, has none of them.

Lectotypification of Carex ×musashiensis

When Ohwi (1936) published *Carex ×musashiensis*, he cited a specimen 'm. Takao in Musashi (T. Suto)' without specifying the herbarium. This specimen is, however, not found in KYO where he is known to have worked.

Ohwi (1936) also cited a name *C. sharensis* (non Franch.) Akiyama (1935), in which a specimen was cited for *C. sharensis* as 'in monte Takao, prov. Musashi (T. Suto [Chiharu Suto], anno 1932)' and they seem to be the same specimen. Because any other specimens referable to original material are not found in SAPS where Akiyama is known to have worked, we here designate the specimen, C. Suto (SAPS, Fig. 2) as the lectotype of *C. ×musashiensis*. Kato and Takahashi (2009) confirmed this specimen in the Herb. S. Akiyama in SAPS as the material used in Akiyama (1955: 107, t. 86-2) for *C. sharensis* Franch. var. *musashiensis* (Ohwi) Akiyama.

Taxonomic treatment

Carex ×musashiensis Ohwi, Mem. Coll. Sci. Kyoto Imp. Univ. ser. B, **11**(5): 512 (1936), pro *C. curvicolis* Franch. & Sav. × *C. thunbergii* Steud. – *C. sharensis* Franch. var. *musashiensis* (Ohwi) Akiyama, Carices of the Far Eastern Region of Asia: 107 (1955).

Lectotype (here designated): Mt. Takao, Prov. Musashi, 8 May 1932, Chiharu Suto s.n. (SAPS!).

C. sharensis auct. non Franch.: Akiyama, Trans. Sapporo Nat. Hist. Soc. **14**: 1209 (1935).

Presumption (amended): *Carex curvicolis* Franch. & Sav. × *C. forficula* Franch. & Sav.

Japanese name. Takao-suge.

Plant densely tufted, short rhizomatous. Culms 30–50 cm, nodding above, slightly scabrous on the angles. Leaf blades as long as culms, flat, 2.5–5.0 mm wide, pale green beneath, scabrous on margin. Basal sheath 1.5–8 cm long, pale to dark brown, splitting ventrally into inconspicuous reticulate fibers or unraveled. Spikes 4–5, the terminal staminate, the laterals pistillate. Bracts sheathless, the lower ones leaf-like, the upper ones scale-like. Staminate spikes linear, 2.5–4.0 cm long; peduncles slightly scabrous, 1.0–4.0 cm long; scales narrowly oblong, 3.5–4.5 mm long, 1.2 mm wide, brown to dark brown, obtuse to acute at apex, opaque; anthers usually remaining in the scales without

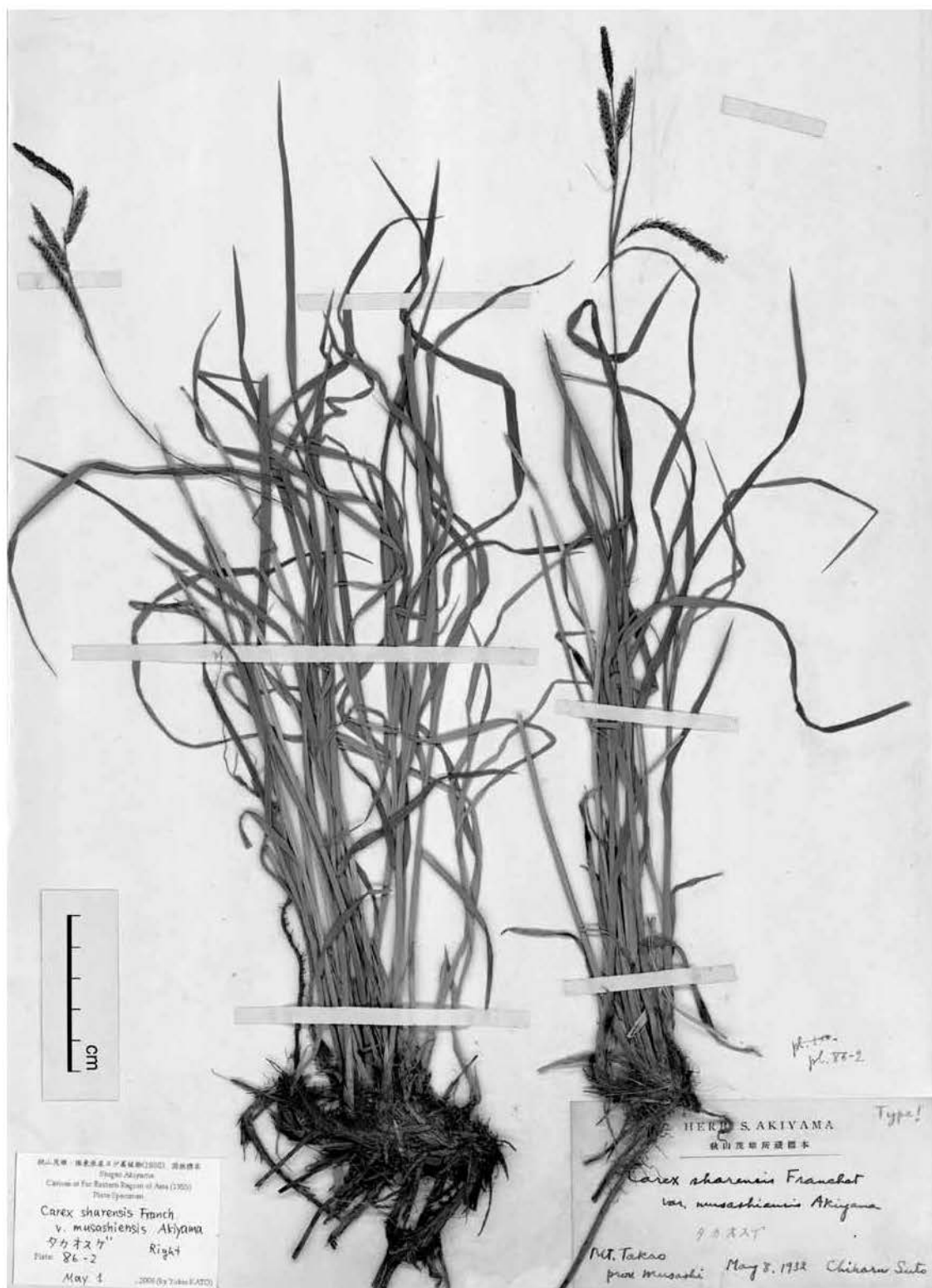


Fig. 2. Lectotype of *Carex x musashiensis* Ohwi, C. Suto s.n. (SAPS). Note the plants with short rhizomes.

dehiscing. Pistillate spikes 3–4, slightly spread, cylindric, 1.6–4.2 cm long, the lower ones sometimes branching a few short spikes at the base; scales shorter than perigynia, narrowly ovate, 2.0–2.5 mm long, dark purplish-brown, short mucronate at apex, the midrib slightly elevated abaxially, green. Perigynia 2.5–3.0 mm long, flattened, smooth except the margin sparsely scabrate, gradually narrowed into a long beak; beak slightly scabrous on the margin, the apex slightly 2-toothed. Achene never maturing, stigmas 2 and 3 intermingled in a spike.

Habitat. On rocks or on rocky riverbed along mountain streams.

Specimens examined. **Hoshu.** Tokyo Pref.: Mt. Takao, 8 May 1932, C. Suto s.n. (Lectotype, SAPS); Mt. Takao, Hachijoji City, anno 1924, T. Makino s.n. (KYO, MAK 220296).

Shikoku. Tokushima Pref.: Akatani–Hirano, Yamashiro-cho, Miyoshi-shi, 580–600 m alt., 29 Apr. 2009, S. Kinoshita 15820, 15822 (KYO); Akatani, Yamashiro-cho, Miyoshi-shi, 580 m alt., 30 Apr. 2009, S. Kinoshita 15828, 15830 (KYO); Akatani, Yamashiro-cho, Miyoshi-shi, 520 m alt., 29 Apr. 2010, Nagamasu 8410, 8413 (KYO).

永益英敏^{a*}, 木下 寛^b: ナルコスゲとタニガワスゲの自然雑種とタカオスゲのレクトタイプ指定

ナルコスゲとタニガワスゲの自然雑種と推定される植物が徳島県三好市で発見された。花粉は不稔で果実は発達せず、多くの形態的特徴がナルコスゲとタニガワスゲの中間的な形質を示す。形態的特徴はタカオスゲ *Carex × musashiensis* とよく一致したが、タカオスゲはナルコスゲとアゼスゲの雑種として高尾山（東京都）から報告された植物である。しかし徳島県の新産地は岩の多い溪流沿いで、水田や湿地に多く見られるアゼスゲは生育していない。また本雑種の特徴にはナルコスゲとアゼスゲの組み合わせによる雑種としては説明が難しい点がある。本論文ではタカオスゲをナルコスゲとタニガ

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ワスゲの雑種として新しく位置づけ、詳しい記載文を与えることにした。

タカオスゲは標本 'm. Takao in Musashi (T. Suto)' を引用して発表されたが、所蔵標本館は明記されなかった。北海道大学 (SAPS) の秋山茂男標本 (Herb. S. Akiyama) を検討したところ、原資料と思われる須藤千春の採集品 (C. Suto, anno 1932) があることがわかり、この標本をレクトタイプとして指定する。

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